

Incidence of foodborne illnesses: 1999 data from FoodNet

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Foodborne illnesses represent a large burden on the US population and public health system. The Foodborne Diseases Active Surveillance Network (FoodNet) collects data on foodborne diseases in eight US sites. Since 1997, there has been a 19% decline in the incidence of bacterial foodborne infections. The 1999 FoodNet data indicated a 19% decrease in incidence of *Campylobacter* infections and a 44% decrease in incidence of *Shigella* infections from 1998 to 1999. In 1999 the rate of *Salmonella* infections increased, whereas the rate of *E. coli* O157 infections decreased. These declines were concurrent with several interventions, including implementation of mandated changes in meat and poultry processing plants, increased attention to 'good agricultural practices', and increased consumer awareness.

Keywords: Foodborne illness; FoodNet; surveillance

Introduction

Foodborne infections are an important public health challenge. The US Centers for Disease Control and Prevention (CDC) estimates that in 1997, foodborne infections caused 76 million illnesses, 325,000 hospitalizations, and 5,000 deaths. CDC, the Food Safety and Inspection Service (FSIS) of the United States Department of Agriculture (USDA), the Food and Drug Administration (FDA),

and the eight Emerging Infections Program (EIP) sites are actively involved in preventing foodborne diseases. In 1997, the interagency national Food Safety Initiative was established to meet the public health challenge of foodborne diseases. CDC's principal role in the Food Safety Initiative has been to enhance surveillance and investigation of infections that are usually foodborne. This mission is being accomplished through several activ-

ities including the Foodborne Diseases Active Surveillance Network (FoodNet). FoodNet is the principal foodborne-disease component of the CDC's EIP, and is a collaborative project among CDC, the eight EIP sites, FSIS, USDA, and FDA. FoodNet augments, but does not replace, longstanding activities at these agencies and at the state level to identify, control, and prevent foodborne disease hazards.

FoodNet is a sentinel network that is producing more stable and accurate national estimates of the burden and sources of specific foodborne diseases in the United States through active surveillance and additional studies. Enhanced surveillance and investigation are integral parts of developing and evaluating new prevention and control strategies that can improve the safety of our food and the public's health. Ongoing FoodNet surveillance is being used to document the effectiveness of new food safety control measures, such as the USDA Pathogen Reduction and Hazard Analysis and Critical Control Points (HACCP) Rule, that are designed to decrease the number of cases of foodborne diseases in the United States each year.

Objectives

The objectives of FoodNet are to determine the frequency and severity of foodborne diseases; determine the proportion of common foodborne diseases that result from eating specific foods; and describe the epidemiology of new and emerging bacterial, parasitic, and viral foodborne pathogens. To address these objectives, FoodNet uses active surveillance and conducts related epidemiologic studies. By monitoring the burden of foodborne diseases over time, FoodNet can document the effectiveness of new

food safety initiatives, such as the USDA HACCP Rule, in decreasing the rate of foodborne diseases in the United States each year.

Methods

Since 1996, FoodNet has conducted population-based active surveillance for laboratory confirmed cases of *Campylobacter*, *Cryptosporidium*, *Cyclospora*, Shiga toxin-producing *Escherichia coli* O157, *Listeria*, *Salmonella*, *Shigella*, *Vibrio*, and *Yersinia* infections. In 1999, participating sites included Connecticut, Georgia, Minnesota, and Oregon and selected counties in California, Maryland, and New York (total population 25.6 million). To identify cases, FoodNet personnel contacted each of the clinical laboratories (> 300) serving the catchment areas, either weekly or monthly, depending on the size of the clinical laboratory. FoodNet also conducts surveillance for hemolytic uremic syndrome through pediatric nephrologists, and surveillance for foodborne disease outbreaks.

Results

Cases reported

In preliminary results for 1999, a total of 10,697 confirmed cases of infections caused by the pathogens under surveillance were identified in the seven sites. Of these, 10,209 were bacterial, caused by 3794 *Campylobacter* infections, 4533 *Salmonella* infections, 1031 *Shigella* infections, 530 *E. coli* O157 infections, 163 *Yersinia* infections, 113 *Listeria* infections, and 45 *Vibrio* infections. Of the 4095 *Salmonella* isolates that were serotyped, the most commonly identified serotypes were Typhimurium (982 cases), Enteritidis (403), Newport (362), Heidelberg (284), and München (231). In addition, 488 cases of parasitic diseases were

reported, including *Cryptosporidium* and *Cyclospora* infections.

Seasonality

Isolation rates for *Salmonella* show seasonal variation; 35% of *Salmonella* infections were reported during June through August, 41% of *E. coli* O157 infections were reported during the winter months with 15% reported during January and December.

1999 Rates

To compare the rates of foodborne diseases at sites with different population sizes, the primary annual incidence rate was calculated. Incidence is calculated by dividing the number of cases reported here by the population. These rates are used to compare estimates and are the preliminary. Final incidence rates are available once 1999 data are available in more detail. Incidence rates were higher with *Salmonella*

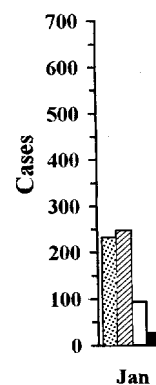


Figure 1: Cases of foodborne diseases reported during January. Data from FoodNet.

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Seasonality

Isolation rates for pathogens showed sea-
sonal variation; 35% of *Campylobacter*,
40% of *Salmonella*, 37% of *Shigella*, and
41% of *E. coli* O157 were isolated during
June through August (Figure 1). *Yersinia*
infections were more likely to occur in
winter months with 40% of cases being
reported during January, February, or
December.

1999 Rates

To compare the number of cases among
sites with different populations, prelimi-
nary annual incidence rates were calcu-
lated. Incidence is the number of cases
divided by the population. All 1999 rates
reported here use 1998 population esti-
mates and are therefore considered pre-
liminary. Final incidence data will be
available once 1999 population estimates
are available in mid-2000. Overall inci-
dence rates were highest for infections
with *Salmonella* (17.7/100,000 popula-

tion), *Campylobacter* (14.8/100,000), and
Shigella (4.0/100,000). Lower overall inci-
dence rates were reported for *Cryp-*
tosporidium (1.5/100,000), *E. coli* O157
(2.0/100,000), *Yersinia* (0.6/100,000), *Lis-*
teria (0.5/100,000), *Vibrio* (0.2/100,000),
and *Cyclospora* (0.04/100,000).

Rates by site

Incidence rates for many of these
pathogens varied substantially among the
sites (Figure 2). The incidence rates for
Campylobacter infection varied from
6.6/100,000 in Maryland to 32.5/100,000
in California and for *Shigella* infections,
from 1.7/100,000 in New York to
9.7/100,000 in California. Incidence rates
for aggregate *Salmonella* infections also
varied among the sites, from 12.7/100,000
in New York to 25.5/100,000 in Georgia.
Among the two most common serotypes
of *Salmonella*, *S. Typhimurium* ranged
from 2.0/100,000 in New York to
4.6/100,000 in Georgia and *S. Enteritidis*
ranged from 0.7/100,000 in New York to
4.0/100,000 in Maryland. Incidence rates
for *E. coli* O157 infection varied from
0.6/100,000 in Georgia to 5.8/100,000 in

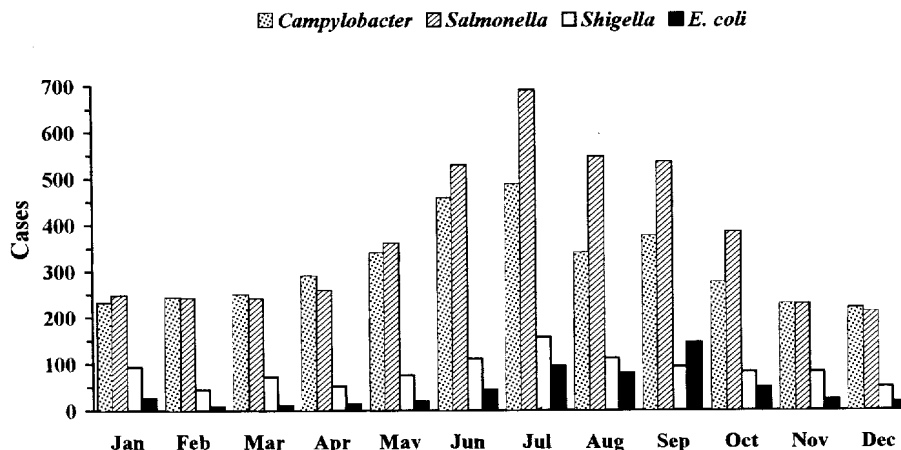


Figure 1: Cases of foodborne disease caused by specific pathogens, by month in 1999. Data from FoodNet.

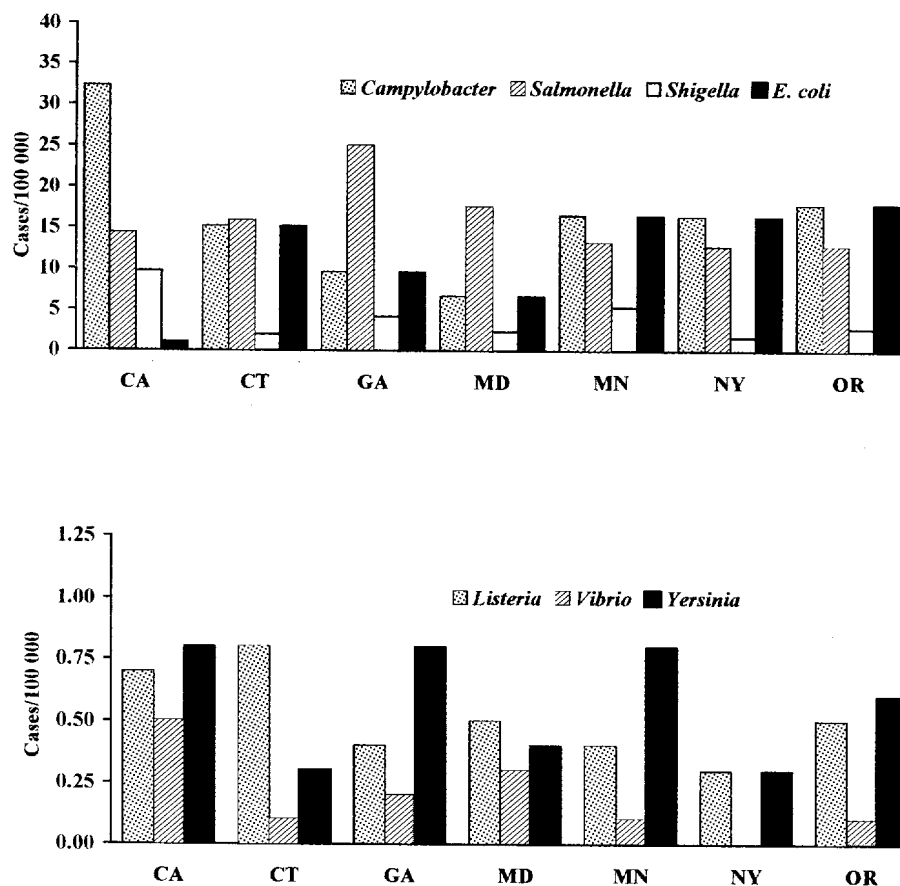


Figure 2: Cases per 100,000 population of foodborne disease caused by specific pathogens in 1999. Data from FoodNet. (CA, California; CT, Connecticut; GA, Georgia; MD, Maryland; MN, Minnesota; NY, New York; OR, Oregon).

New York. Some New York cases are related to a large waterborne outbreak of *E. coli* O157 infections that occurred in 1999. Infections caused by *Yersinia* varied from 0.3/100,000 in New York and Connecticut to 0.8/100,000 in California and Georgia. Incidence rates of *Cryptosporidium* cases ranged from 0.3/100,000 in Maryland to 2.3/100,000 in Georgia. Reasons for these regional differences in incidence rates are being investigated; they may be due in part to the fact that most laboratories do not test specimens routinely for all pathogens. Regional dif-

ferences in *E. coli* O157 incidence are not accounted for by regional differences in laboratory practices.

Rates by age

Annual incidence rates of foodborne illness varied by age, especially for *Campylobacter* and *Salmonella* infections. For children <1 year of age, the rate of *Salmonella* infection was 146.5/100,000 and the rate of *Campylobacter* infection was 40.6/100,000, rates substantially higher than for other age groups.

Rates by sex

Incidence rates for males were more than twice those for females for *Cyclospora* and *Yersinia* were approximately 64% higher among males, and *Campylobacter* infection was 12% higher among

Rates by age and sex

The incidence rates for males were higher than for females for all ages of 60 and over. *Salmonella* infection was higher among males for all ages and the age group 60 and over compared with females.

Hospitalisations

Preliminary data on hospitalisations of culture-confirmed foodborne infections showed that hospitalisation was markedly by pathogen. Hospitalisation was highest for *Yersinia* and *Salmonella*.

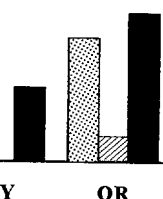
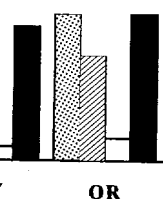
Table 1. Rate¹ and

Pathogen

Campylobacter
Cryptosporidium
Cyclospora
E. coli O157
Listeria
Salmonella
Shigella
Vibrio
Yersinia
S. enteritidis
S. typhimurium

¹Per 100,000 population

²Not reported.

■ *E. coli*

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Rates by sex

Incidence rates varied by sex. Overall, males were more likely than females to be infected with every pathogen except *Cyclospora* and *Yersinia* (for which rates were approximately equal for both sexes). Rates of *Cryptosporidium* infection were 64% higher among males, rates of *Campylobacter* infection were 21% higher among males, and rates of *Shigella* were 12% higher among males.

Rates by age and sex

The incidence rate of *Campylobacter* infection was higher for males than for females in all age groups, except for those of 60 and over. The incidence rate of *Salmonella* infection was higher among males for all age groups under 30 years and the age group 40 to 49 years compared with females.

Hospitalisations

Preliminary data show that overall, 19% of culture-confirmed persons were hospitalised; hospitalisation rates differed markedly by pathogen. The rate of hospitalisation was highest for persons in-

fectured with *Listeria* (88%) followed by those infected with *E. coli* O157 (37%), *Yersinia* (36%), *Vibrio* (25%), *Salmonella* (22%), *Shigella* (14%), and *Campylobacter* (11%).

1996-1999 Rates

For the five original sites, overall incidence rates of illness caused by pathogens under surveillance declined from 1996 to 1999 (Table 1). Infections caused by *Campylobacter* and *Shigella* showed the largest decrease, from 23.5/100,000 and 8.9/100,000 in 1996 to 17.3/100,000 and 5.0/100,000 in 1999, representing 19% and 41% declines, respectively. *E. coli* O157 infections declined 22% from 1996 to 1999, *Yersinia* infections declined 20% in the same time period, and *Cryptosporidium* infections declined by only 3% from 1997 to 1999. The overall incidence of salmonellosis decreased 15% from 1996 to 1998; however, the incidence increased 20% from 1998 to 1999. Compared with 1998 rates, 1999 rates for salmonellosis increased in Connecticut, Georgia, Minnesota, and Oregon, and declined in California. Rates for *S.*

Table 1. Rate¹ and percent change of selected pathogens detected by FoodNet at the five original sites, by year and pathogen, 1996-1999

Pathogen	1996	1997	1998	1999	% change		
					1996 to 1999	1997 to 1999	1998 to 1999
<i>Campylobacter</i>	23.5	25.2	21.4	17.3	26	-31	-19
<i>Cryptosporidium</i>	NR ²	3.0	3.4	2.9	NR ²	-3	-15
<i>Cyclospora</i>	NR ²	0.3	< 0.1	< 0.1	NR ²	-67	0
<i>E. coli</i> O157	2.7	2.3	2.8	2.1	-22	-9	-25
<i>Listeria</i>	0.5	0.5	0.6	0.5	0	0	-17
<i>Salmonella</i>	14.5	13.6	12.3	14.8	-2	9	+20
<i>Shigella</i>	8.9	7.5	8.5	5.0	-44	-33	-41
<i>Vibrio</i>	0.1	0.3	0.3	0.2	+100	-33	-33
<i>Yersinia</i>	1.0	0.9	1.0	0.8	-20	-11	-20
<i>S. enteritidis</i>	2.5	2.3	1.4	1.3	-48	-43	-7
<i>S. typhimurium</i>	3.9	3.9	3.7	3.6	-8	-8	-3

¹ Per 100,000 population.

² Not reported.

Typhimurium, the most common serotype, were constant from 1996 to 1999 (3.9 to 3.6 respectively). SE rates declined 48% from 1996 to 1999 with a 7% decline from 1998 to 1999 (Table 1). From 1998 to 1999, *Salmonella* infections with serotypes München, Newport and Heidelberg increased 348%, 79%, and 44%, respectively. The incidence of *Vibrio* infections, which increased substantially from 1996 through 1998, declined in 1999. Incidence rates for *Listeria* have been slightly higher in the past 2 years, in the setting of a large multistate outbreak. The incidence of illness caused by *Cryptosporidium* were constant (2.8/100,000 in 1997 to 2.2/100,000 in 1999), and *Cyclospora* decreased from 0.3/100,000 in 1997 to <0.1/100,000 in 1999.

1997-1999 Rates

CDC estimates of the burden of foodborne illness in the United States (Mead *et al.*, 1999) are largely based on 1997 FoodNet data. In those estimates, the bacterial foodborne pathogens included in FoodNet surveillance caused an estimated 4.5 million illnesses annually. Since 1997 the aggregate incidence of these bacterial pathogens has declined 19%.

Conclusion

FoodNet 1999 surveillance activities show a 19% overall decline in incidence of the bacterial foodborne infections since 1997. Although these declines might reflect simple annual fluctuations in foodborne illness, they occurred in the context of several disease prevention interventions. Each of these prevention efforts may have affected the incidence of foodborne disease. For example, the decline in *Campylobacter* infections, commonly associated with poultry, is likely related to changes

in poultry processing plants instituted by industry and encouraged by the Pathogen Reduction and HACCP rule of the USDA that may be leading to less *Campylobacter* contamination of poultry. The decline in *Shigella* follows a large outbreak of shigellosis in 1998 traced to imported parsley, which focused attention on the problems of produce-associated shigellosis and the need for improving basic sanitation on producing farms throughout the continent. The continued decline of *S. enteritidis*, an egg-associated serotype, occurred in the setting of increased farm-to-table control measures. Increases in other *Salmonella* serotypes may be related to large outbreaks associated with unpasteurised orange juice, raw sprouts, and mangos. The decreased rate of *E. coli* O157 infections in 1999 represents a 4-year FoodNet low. This decline occurs in the setting of improved sanitation and hygiene in slaughter and processing plants and restaurant and consumer attention to hamburger cooking temperatures. Further surveillance is needed to clarify whether this new low is the beginning of a trend. FoodNet surveillance is a precise and ongoing measure of foodborne illnesses which continues to help evaluate geographical and regional trends in foodborne illnesses in the United States.

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The topic of rapid research and investigation and identification and environmental procedures, miniaturised systems and genetic information in outlines the development and sample preparation instruments for microbiological and genetic-based assays

Keywords: Food; micro

Int

Rapid methods in microbiology are those that address the biological, chemical, immunological, and molecular methods for the study of early detection, enumeration of their products in